

# Upper Carboniferous to Lower Permian continental deposits in Sardinia (Italy)

Giuseppe CASSINIS & Ausonio RONCHI

Dipartimento di Scienze della Terra,  
Via Abbiategrasso 217, 27100 Pavia (Italy)

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## ABSTRACT

The paper is a brief outline on the sedimentary and volcanic continental successions of a number of Sardinian basins, which have been attributed to Permian and, locally, also to Late Carboniferous times. In general this (late)-postHercynian picture is similar, in most aspects, to the situation in nearby Corsica, and is also reminiscent of conditions in South France and Spain, with which Sardinia and Corsica were linked before beginning their drift toward the Tyrrhenian.

## RÉSUMÉ

Cette note est un aperçu des successions sédimentaires et de volcanisme continental dans les bassins de Sardaigne qui ont été attribués au Permien et, localement, au Carbonifère supérieur. En général, cette photographie du (tardi)-posthercynien est similaire dans la plupart de ses aspects à la situation de la Corse voisine et évoque aussi ce que l'on connaît en France méridionale et en Espagne, avec lesquelles la Sardaigne et la Corse étaient liées avant leur séparation vers la Tyrrhénienne.

## KEY WORDS

continental basins,  
sedimentary deposits,  
igneous products,  
Upper Carboniferous,  
Lower Permian,  
Sardinia.

## MOTS CLÉS

bassins continentaux,  
dépôts sédimentaires,  
produits ignés,  
Carbonifère supérieur,  
Permien inférieur,  
Sardaigne.

After the Hercynian orogeny, during Late Carboniferous and Early Permian times, a large-scale calcalkaline magmatism took place on the island (Fig. 1). The intrusive sequence gave rise to hundreds of plutons over a period of more than 25 Ma, from at least 310 Ma to about 280 Ma. This plutonic complex forms the southern part (about 6000 km<sup>2</sup>) of the Sardinian-Corsican batholith, which, in Sardinia, largely comprises tonalites to tonalitic granodiorites and younger monzogranitic granodiorites to leucomonzogranites. Post-tectonic plutons, which

occurred under a tensional regime after rapid regional uplift, contain leucogranites (Ghezzi & Orsini 1982; Carmignani *et al.* 1989).

The (late)-post-Hercynian terrigenous and volcanic sequence lies unconformably on a heterogeneous, generally tectonized metamorphic basement. As in many parts of Permian-Carboniferous continental Europe, it is made up both of fluvial to lacustrine clastic deposits, which accumulated within more or less subsiding fault-bounded basins, and of wider volcanic products, which are generally acidic to intermediate in composition.

At present, the San Giorgio Basin in Iglesiente (SW Sardinia) appears to be the oldest Upper Palaeozoic sedimentary outcrop on the island (Fig. 2). Its upper detrital deposits, on the basis of fossil macroflora with *Pecopteris*, *Calamites*, *Neuropteris*, *Cordaites*, etc. (Cocozza 1967), and of palynoflora which yields *Calamospora pallida*, *Florinites parvus*, etc. (Del Rio 1973), have been identified as belonging to the Upper Stephanian. More recently, however, in the lowermost layers, the discovery of tetrapod footprints, which have been referred to the genus *Salichnium* (already recorded from the Westphalian of Central Europe and North Africa) and thus attributed to microsaur, has encouraged the hypothesis that the sedimentation may have begun in the San Giorgio Basin in former times (Fondi 1980).

On the other hand, during the Early Permian, a certain number of well-developed basins (Mt. Lu Caparoni in Nurra, Seui-Seulo in Barbagia, Perdadedogiu in Ogliastra, Escalaplano in Gerrei, Lake Mulargia in Sarcidano, Guardia Pisano in Sulcis) occurred on the island. They were characterized by the above-mentioned (late)-post-Hercynian succession (Fig. 2), during which volcanic products (tuffs, ignimbrites, lavas and other igneous extrusive aspects) played an important role, and were widespread over external areas. These continental deposits, which range in thickness from a dozen to some hundreds of metres, are normally rich in Autunian plants, such as *Autunia*, *Odontopteris*, *Pecopteris*, *Annularia*, *Ernestodendron*, *Taeniopteris*, *Sphenopteris*, *Cordaites*, etc. (Novarese 1917; Oosterbaan 1936; Maxia 1938; Comaschi Caria 1959; Pecorini 1962, 1974; Gasperi & Gelmini

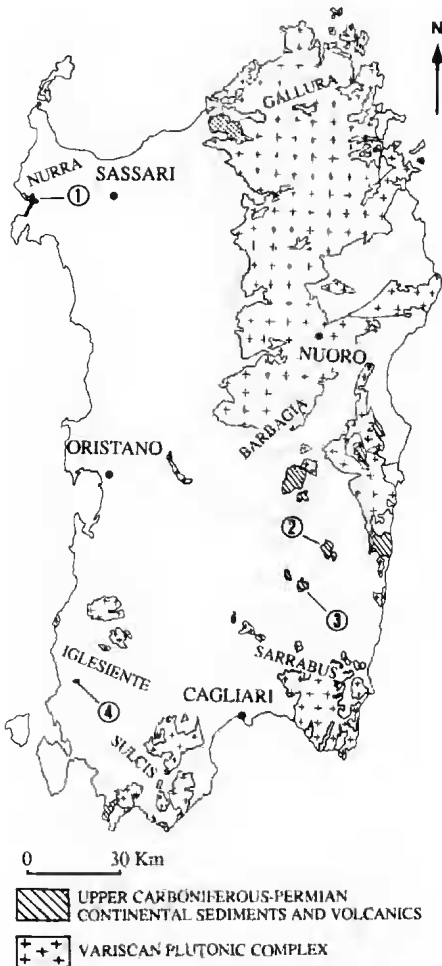


FIG. 1. — Location map of the stratigraphic columns drawn up in Fig. 2. 1, Pta Lu Caparoni; 2, Perdadedogiu; 3, Escalaplano; 4, San Giorgio.

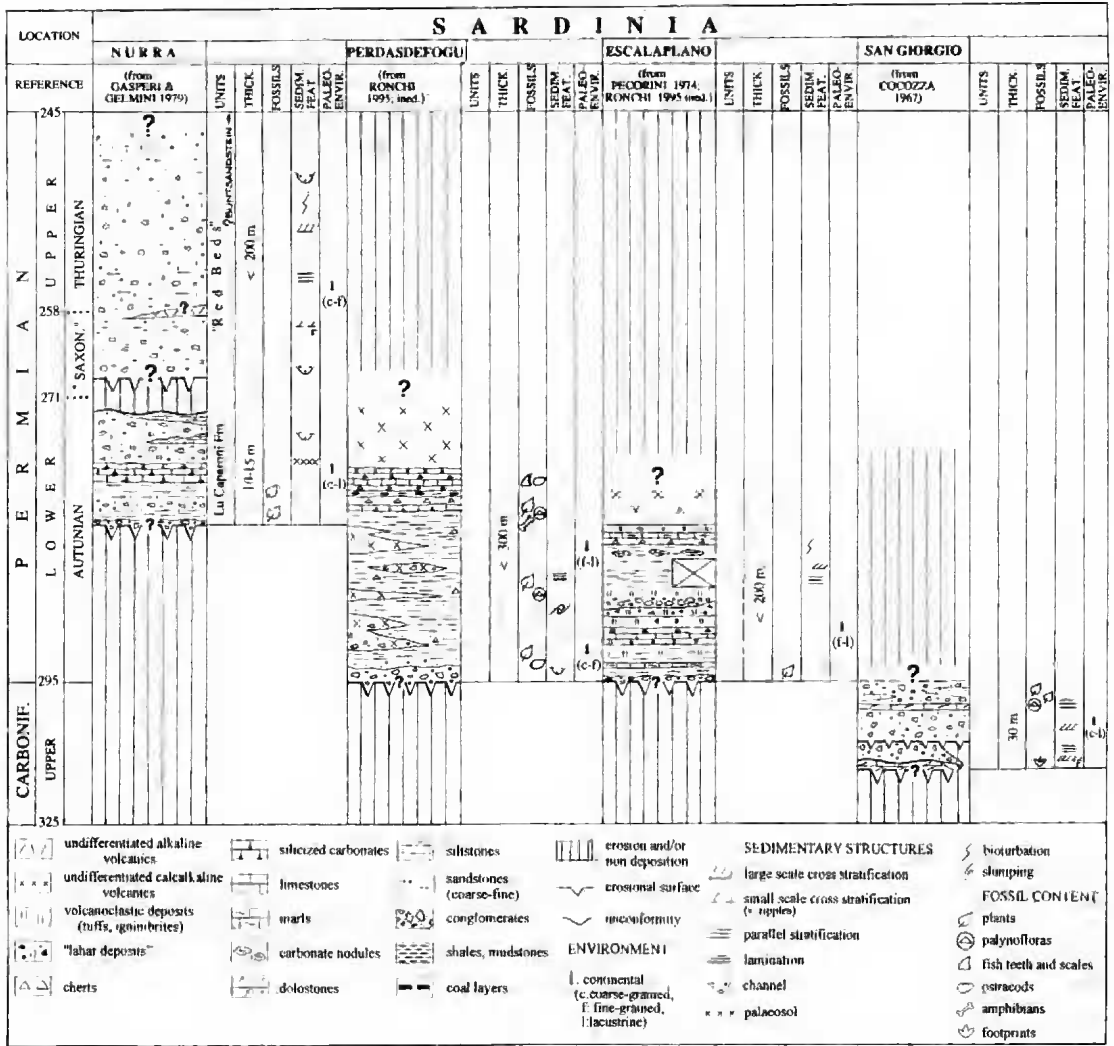


Fig. 2. — Some Upper Palaeozoic sedimentary and volcanic successions of Sardinia. Vertical distances not time or thickness-related. Geologic time scale from Odin & Odin (1990).

1980; Francavilla *et al.* 1977; Broutin pers. comm.) and sporomorphs, such as *Potoniopsis novicus*, *P. bharadwaj*, *Latensina trileta*, *Candidispora candida*, *Cordaitina*, *Florinites*, *Limitosporites*, etc. in the Guardia Pisano basin (Barca *et al.* 1992).

The temporal distribution of the overlying permotriassic, coarse- to fine-grained, mainly red, detritic sediments, as in the Mt. Lu Caparoni and Lake Mulargia basins, is not yet clearly defined. The lower boundary of these clastics pro-

bably seals a gap of different, but still uncertain magnitude. Moreover the radiometric age-dating from a large number of Permian volcanic rocks (Cozzupoli *et al.* 1971, 1984; Del Moro *et al.* 1974; Lombardi *et al.* 1974; Edel *et al.* 1981) produced unreliable results.

From the above, it follows that the (late)-postHercynian picture in Sardinia is similar, in most aspects, to the situation in nearby Corsica, and is also reminiscent of conditions in Provence (France) and Spain, with which Sardinia and

Corsica were united before beginning their drift toward the Tyrrhenian. The Late Carboniferous to Early Permian fault-block landscape may have been formed during the transcurrent regime, which is thought by many to have characterized the European Late Paleozoic climax. This regime was contemporaneous with the extensional movements linked to the progressive thinning of the Hercynian crust.

## REFERENCES

- Barca S., Del Rio M. & Pittau P. 1992. — Lithostratigraphy and microfloristic analysis of the fluvial-lacustrine Autunian basin in the Sulcis area (Southwestern Sardinia, Italy), in Carmignani L. & Sassi F. P. (eds), Contributions to the Geology of Italy, IGCP No. 276, Siena, *Newsletter* 5: 45-49.
- Carmignani L., Cherchi A. & Ricci C. A. 1989. — Basement structure and Mesozoic-Cenozoic evolution of Sardinia, in Boriani A., Bonafede M., Piccardo G. B. & Vai G. B. (eds), The lithosphere in Italy, Advances in Earth Science research, C.N.R., Accademia Nazionale dei Lincei, Roma, *Atti dei Convegni Lincei* 80: 63-92.
- Cocozza T. 1967. — Il Permo-Carbonifero del bacino di San Giorgio (Iglesiente, Sardegna sud-occidentale). *Memorie della Società Geologica Italiana* 6: 607-642.
- Comaschi Caria I. 1959. — Le piante fossili della Sardegna. *Rivista Italiana di Paleontologia*, Memoria 7, 176 p.
- Cozzupoli D., Discendenti A., Lombardi G. & Nicoletti M. 1971. — Cronologia K-Ar delle manifestazioni eruttive del settore Seui-Seulo (Barbagia-Sardegna). *Periodico di Mineralogia* a. 40: 113-124.
- Cozzupoli D., Gerbasi G., Nicoletti M. & Petrucciani C. 1984. — Età K-Ar delle ignimbriti permiane di Galtelli (Orosei-Sardegna orientale). *Rendiconti della Società Italiana di Mineralogia e Petrologia* 39: 471-476.
- Del Moro A., Di Simplicio P., Ghezzi C., Guasparri G., Rita F. & Sabatini G. 1974. — Radiometric data and intrusive sequence in the Sardinia batholith. *Neues Jahrbuch fuer Mineralogie Abhandlungen* 126: 28-44.
- Del Rio M. 1973. — Palinologia di un livello "Permo-Carbonifero" del bacino di San Giorgio (Iglesiente, Sardegna sud occidentale). *Bollettino della Società Geologica Italiana* 92: 485-494.
- Edel B., Montigny R. & Thuizat R. 1981. — Late Paleozoic rotations of Corsica and Sardinia: New evidence from paleomagnetic and K-Ar studies. *Tectonophysics* 79: 201-223.
- Fondi R. 1980. — Orme di microsauri nel Carbonifero superiore della Sardegna. *Memorie della Società Geologica Italiana* 30 (1979): 347-356.
- Francavilla F., Cassinis G., Cocozza T., Gandin A., Gasperi G., Gelmini R., Rau A., Tongiorgi M. & Vai G. B. 1977. — Macroflora e datazione di alcuni affioramenti (tardo)-posttettonici presso il Lago di Mulargia (Sardegna sud-orientale), in Vai G. B. (ed.), Escursione in Sardegna, risultati e commenti, *Bollettino del Gruppo di Lavoro sul Paleozoico*, C.N.R., Parma, 2 (suppl.): 31-33.
- Gasperi G. & Gelmini R. 1980. — Ricerche sul Verrucano. 4. Il Verrucano della Nurra (Sardegna nord-occidentale). *Memorie della Società Geologica Italiana* 20: 215-231.
- Ghezzi C. & Orsini J. B. 1982. — Lineamenti strutturali e composizionali del batolite ercinico sardo-corso in Sardegna in Guida alla Geologia del Paleozoico Sardo. *Società Geologica Italiana: Guide Geologiche Regionali*, Cagliari: 165-181.
- Lombardi G., Cozzupoli D. & Nicoletti M. 1974. — Notizie geopetrografiche e dati sulla cronologia K-Ar del vulcanismo tardopaleozoico sardo. *Periodico di Mineralogia* a. 43: 221-312.
- Maxia C. 1938. — Alcune osservazioni sulla flora autuniana di Perdasdefogu e sul Paleozoico recente della Sardegna. *Rivista Italiana di Paleontologia* a. 44: 107-126.
- Novarese V. 1917. — L'Autuniano in Sardegna. *Bollettino della Società Geologica Italiana* 36: 88-91.
- Odin G. S. & Odin Ch. 1990. — Échelle numérique des temps géologiques. *Géochroniques*, Paris 35: 12-21.
- Oosterbaan A. M. 1936. — *Etude géologique et paléontologique de la Nurra avec quelques notes sur le Permien et le Trias de la Sardaigne méridionale*. Université d'Utrecht, Utrecht, 130 p.
- Pecorini G. 1962. — Nuove osservazioni sul Permico della Nurra (Sardegna nord-occidentale). *Atti della Accademia Nazionale dei Lincei, Rendiconti Classe Scienze fisiche, matematiche e naturali*, Roma, serie 8, 32: 377-380.
- 1974. — Nuove osservazioni sul Permico-Trias di Escalaplano (Sardegna sud-orientale). *Bollettino della Società Geologica Italiana* 93: 991-994.

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